The Muscular System

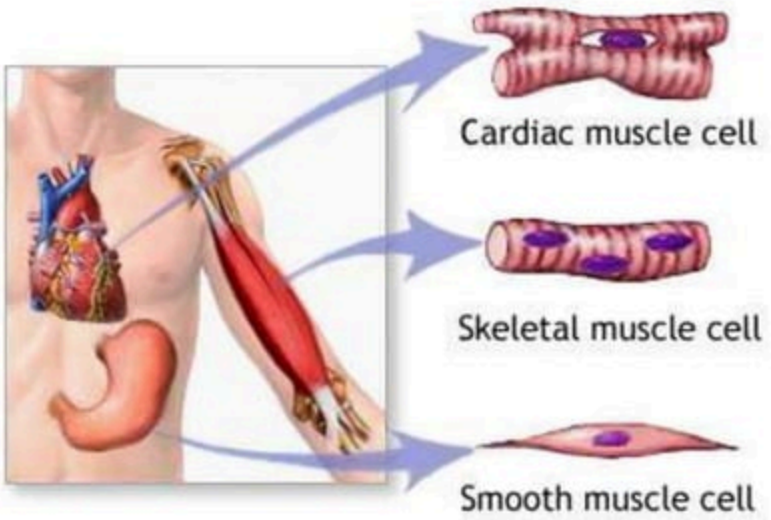
- Muscles are responsible for all ***movement*** of the body
- There are three basic types of muscle
  - ***Skeletal***
  - ***Cardiac***
  - ***Smooth***

Info About Muscles

- Only body tissue able to ***contract***
- create movement by ***flexing*** and ***extending*** joints
- Body ***energy*** converters (many muscle cells ***contain many mitochondria***)



3 Types of Muscles

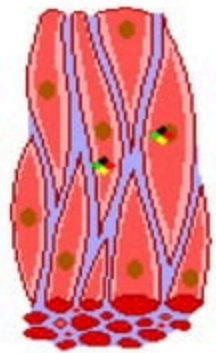


A.D.A.M.

Three types of muscle

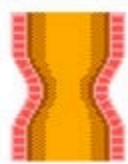












Skeletal **Cardiac** **Smooth**

Classification of Muscle

Skeletal- found in limbs	**Cardiac-** found in heart	**Smooth-** Found in viscera
Striated, multi-nucleated	Striated, 1 nucleus	Not striated, 1 nucleus
voluntary	involuntary	involuntary

Characteristics of Muscle

- Skeletal and smooth muscle are elongated
- Muscle cell = muscle fiber
- Contraction of a muscle is due to movement of ***microfilaments*** (protein fibers)
- All muscles share some terminology
  - Prefixes ***myo*** and ***mys*** refer to muscle
  - Prefix ***sarco*** refers to flesh

Shapes of Muscles

- ***Triangular-*** shoulder, neck
- ***Spindle-*** arms, legs
- ***Flat-*** diaphragm, forehead
- ***Circular-*** mouth, anus

Skeletal Muscle

- Most are attached by ***tendons*** to bones
- Cells have more than one nucleus (***multinucleated***)
- ***Striated-*** have stripes, banding
- ***Voluntary-*** subject to conscious control
- Tendons are mostly made of ***collagen*** fibers
- Found in the limbs
- Produce movement, maintain posture, generate heat, stabilize joints

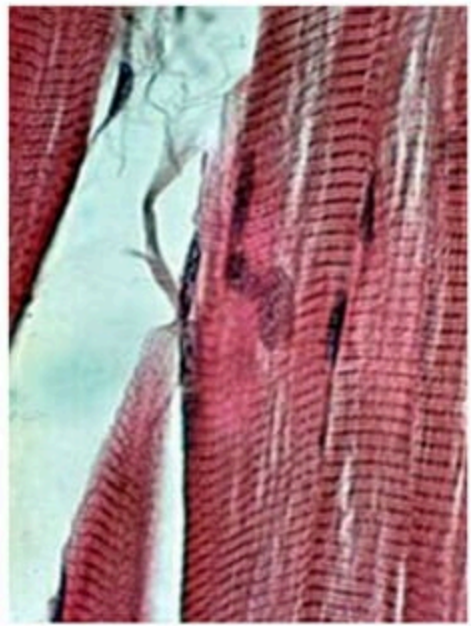
Structure of skeletal muscle

- Each cell (fibre) is long and cylindrical
- Muscle fibres are multi-nucleated
- Typically 50-60mm in diameter, and up to 10cm long
- The contractile elements of skeletal muscle cells are myofibrils



Skeletal muscle - Summary

- Voluntary movement of skeletal parts
- Spans joints and attached to skeleton
- Multi-nucleated, striated, cylindrical fibres



Smooth Muscle

- ***No striations***
- ***Spindle*** shaped
- ***Single*** nucleus
- ***Involuntary-*** no conscious control
- Found mainly in the walls of hollow organs

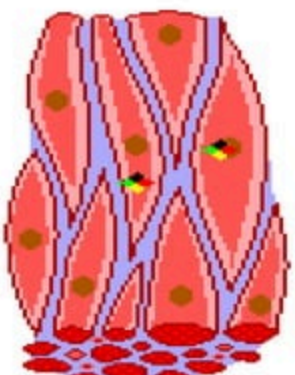
Smooth muscle

- Lines walls of viscera
- Found in longitudinal or circular arrangement
- Alternate contraction of circular & longitudinal muscle in the intestine leads to peristalsis



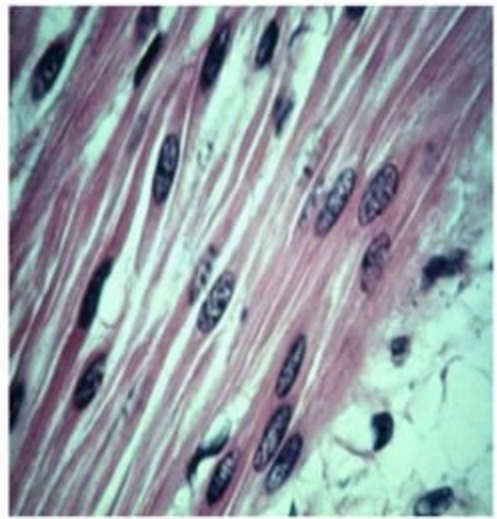
Structure of smooth muscle

- Spindle shaped uni-nucleated cells
- Striations not observed
- Actin and myosin filaments are present(protein fibers)



Smooth muscle - Summary

- Found in walls of hollow internal organs
- Involuntary movement of internal organs
- Elongated, spindle shaped fibre with single nucleus

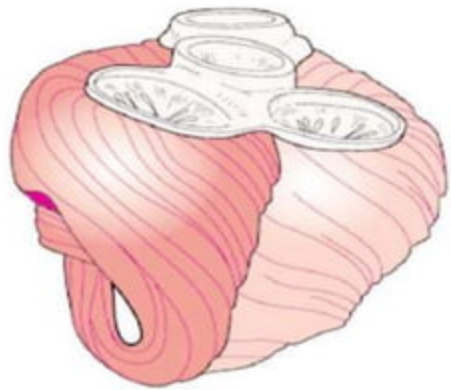


Cardiac Muscle

- ***Striations***
- ***Branching*** cells
- ***Involuntary***
- Found only in the ***heart***
- Usually has a single nucleus, but can have more than one

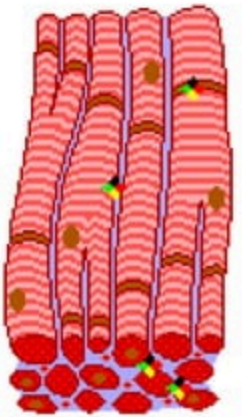
Cardiac muscle

- Main muscle of heart
- Pumping mass of heart
- Critical in humans
- Heart muscle cells behave as one unit
- Heart always contracts to it's full extent



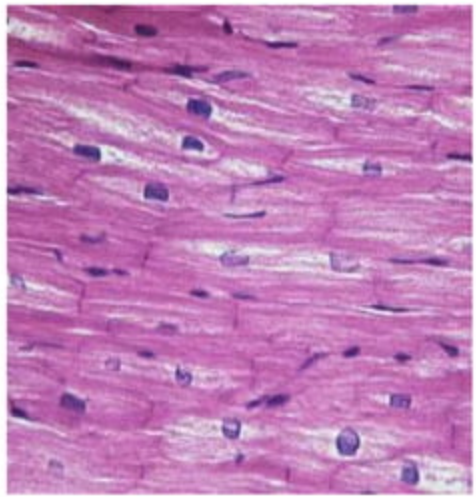
Structure of cardiac muscle

- Cardiac muscle cells (fibres) are short, branched and interconnected
- Cells are striated & usually have 1 nucleus
- Adjacent cardiac cells are joined via electrical synapses (gap junctions)
- These gap junctions appear as dark lines and are called intercalated discs



Cardiac muscle - Summary

- Found in the heart
- Involuntary rhythmic contraction
- Branched, striated fibre with single nucleus and intercalated discs



Muscle Control

Type of muscle	Nervous control	Type of control	Example
Skeletal	Controlled by CNS	Voluntary	Lifting a glass
Cardiac	Regulated by ANS	Involuntary	Heart beating
Smooth	Controlled by ANS	Involuntary	Peristalsis

Types of Responses

- ***Twitch-***
  - A single brief contraction
  - Not a normal muscle function
- ***Tetanus***
  - One contraction immediately followed by another
  - Muscle never completely returns to a relaxed state
  - Effects are compounded

Where Does the Energy Come From?

- Energy is stored in the muscles in the form of ***ATP***
- ATP comes from the breakdown of glucose during ***Cellular Respiration***
- This all happens in the ***Mitochondria*** of the cell
- When a muscle is ***fatigued*** (tired) it is unable to contract because of lack of ***Oxygen***

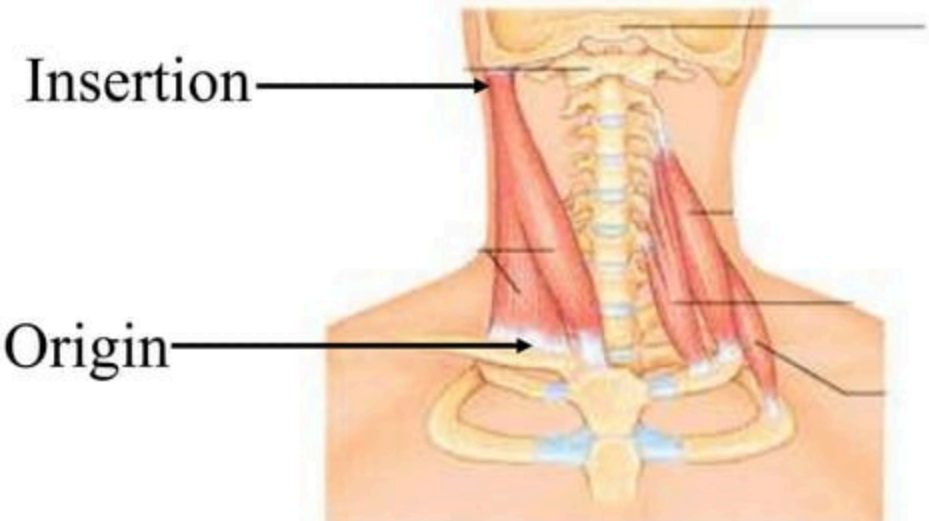
Exercise and Muscles

- ***Isotonic-*** muscles shorten and movement occurs (most normal exercise)
- ***Isometric-*** tension in muscles increases, no movement occurs (pushing one hand against the other)

How are Muscles Attached to Bone?

- ***Origin***-attachment to a movable bone
- ***Insertion***- attachment to an immovable bone
- Muscles are always attached to at least 2 points
- Movement is attained due to a muscle moving an attached bone

Muscle Attachments

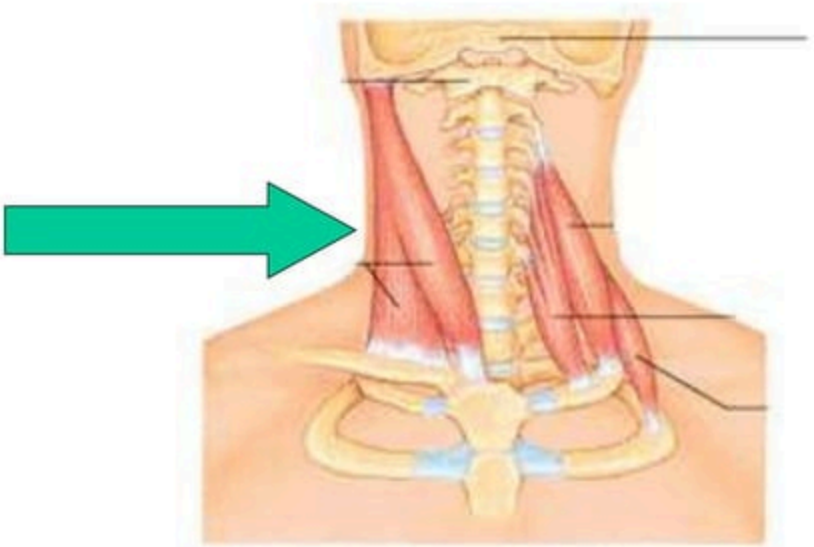


The Skeletal Muscles

There are about 650 muscles in the human body. They enable us to move, maintain posture and generate heat. In this section we will only study a sample of the major muscles.

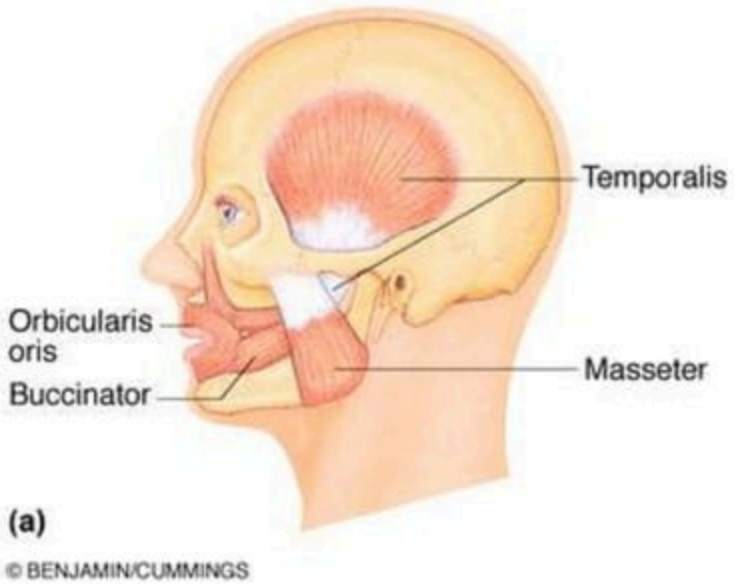
Sternocleidomastoideus

Flexes and Rotates Head



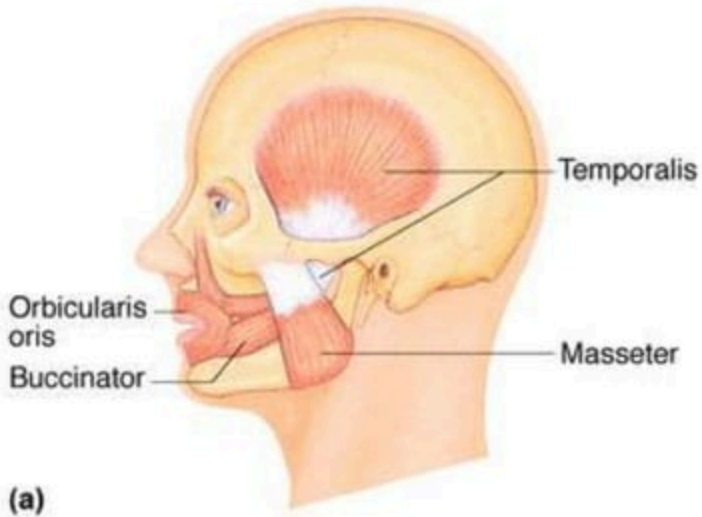
Masseter

Elevate Mandible



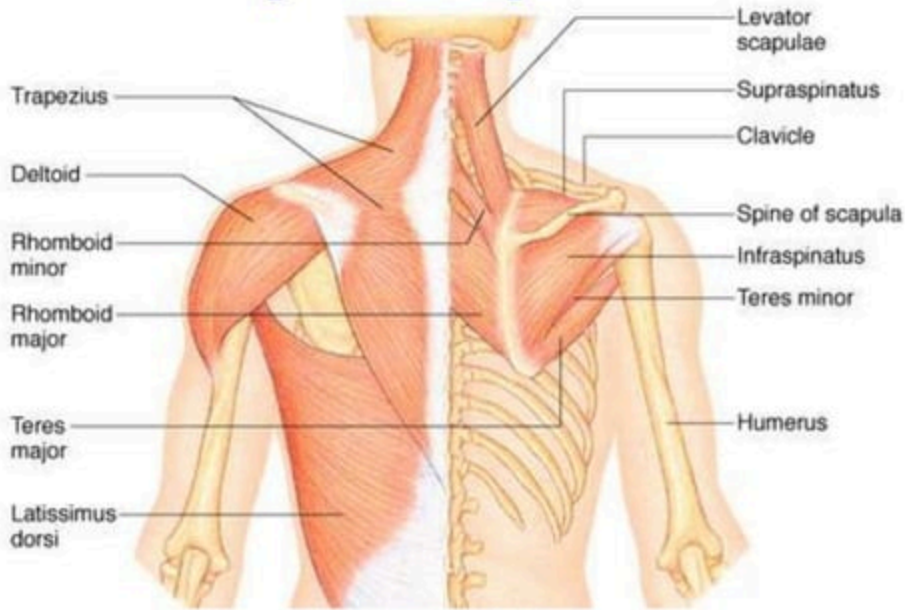
Temporalis

Elevate & Retract Mandible



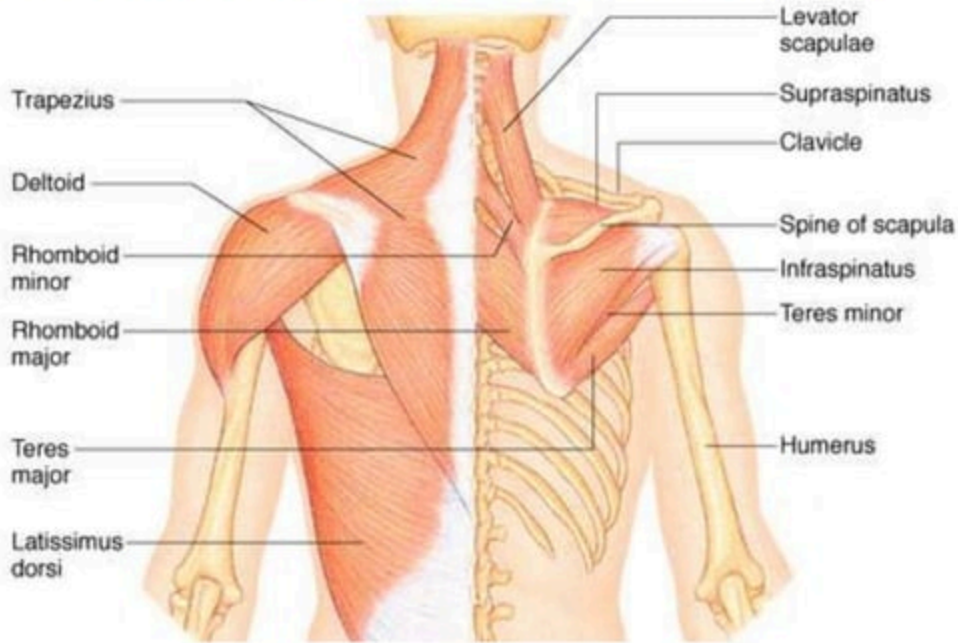
Trapezius

Extend Head, Adduct, Elevate or Depress Scapula



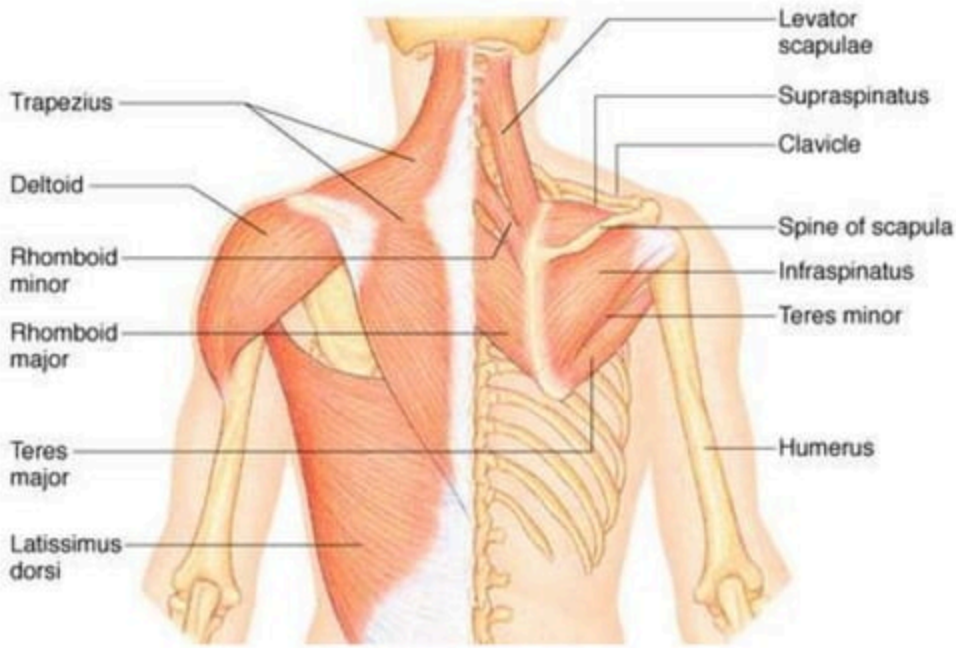
Latissimus Dorsi

Extend, Adduct & Rotate Arm Medially



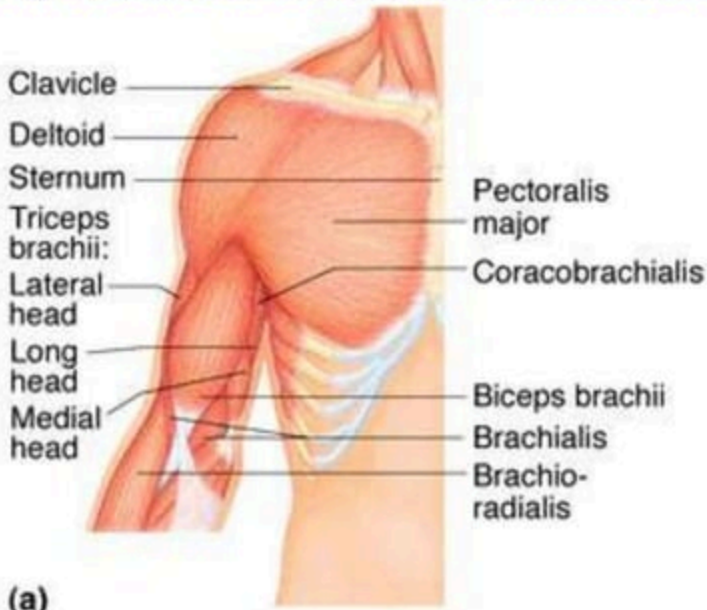
Deltoid

Abduct, Flex & Extend Arm



Pectoralis Major

Flexes, adducts & rotates arm medially



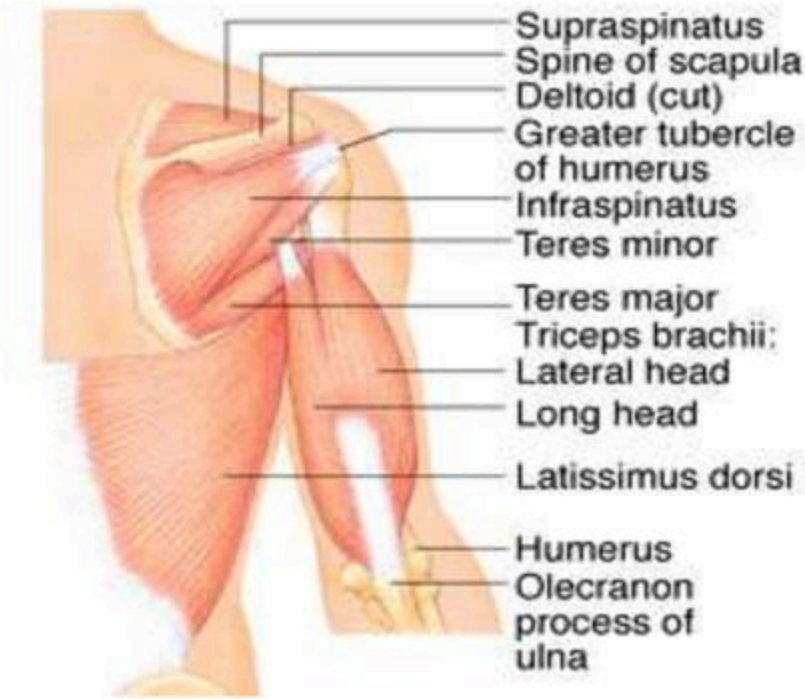
Biceps Brachii

Flexes Elbow Joint



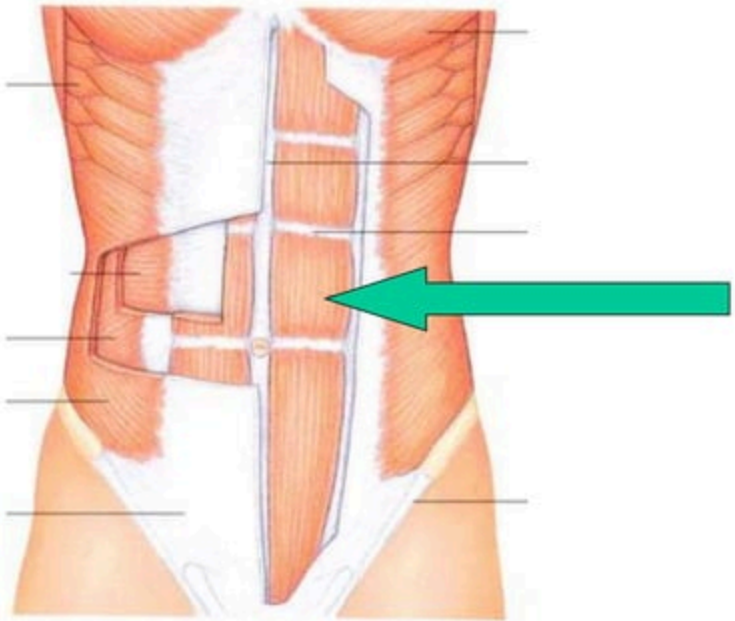
Triceps Brachii

Extend Elbow Joint



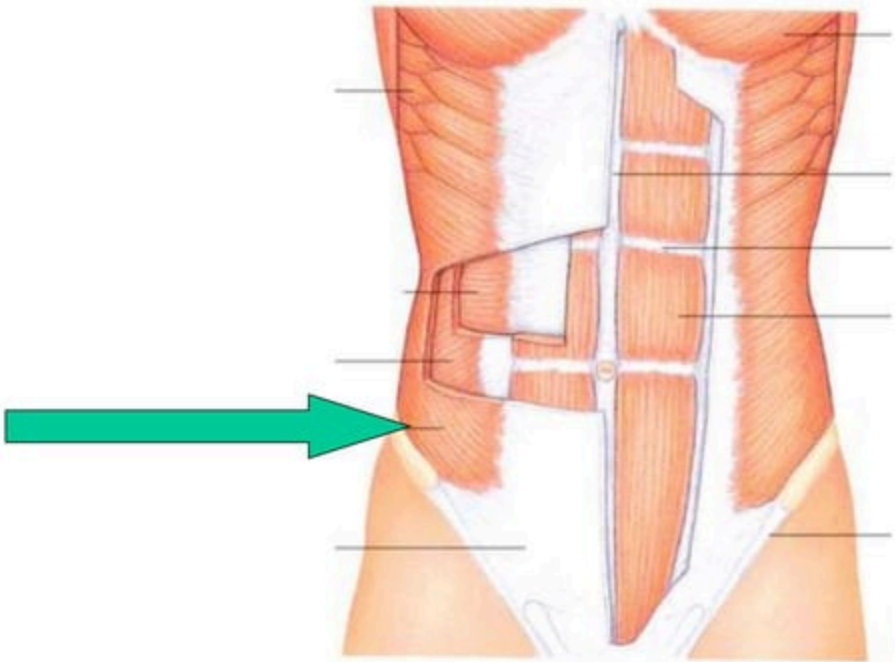
Rectus Abdominus

Flexes Abdomen



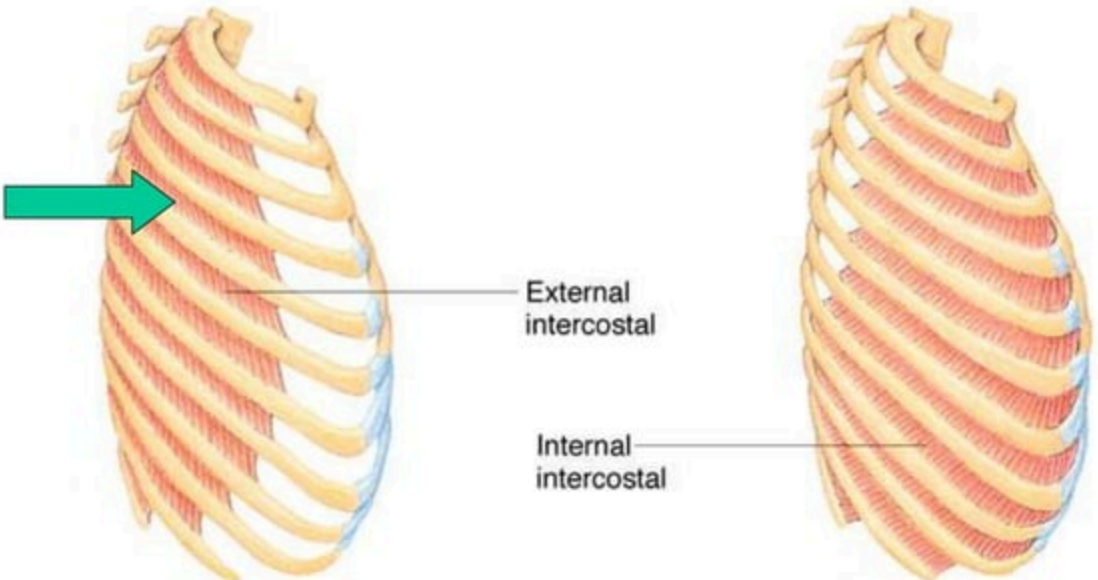
External Oblique

Compress Abdomen



External Intercostals

Elevate ribs

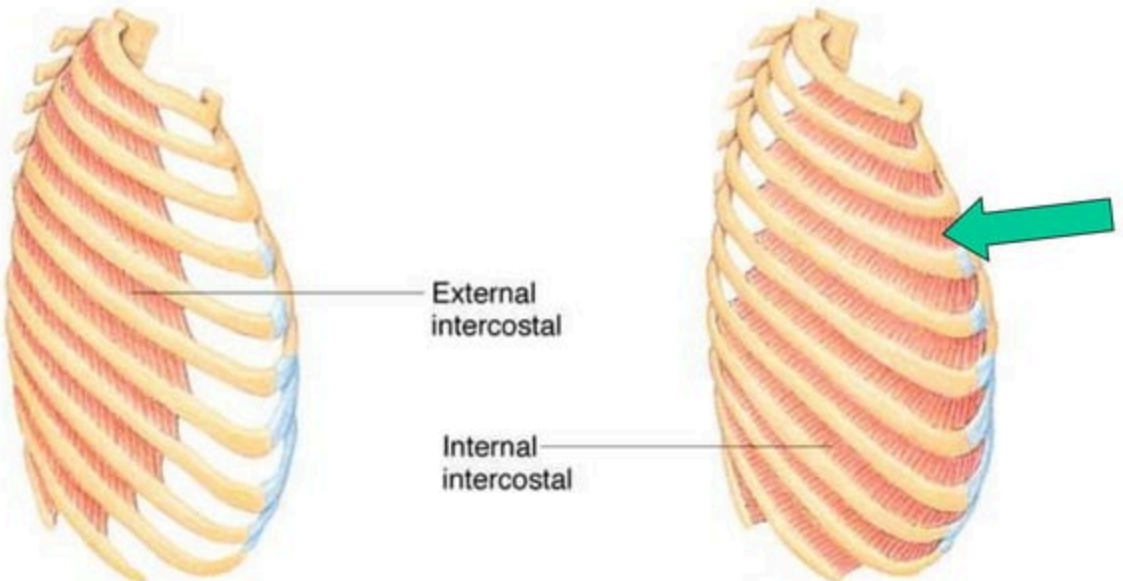


(a)

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Internal Intercostals

Depress ribs

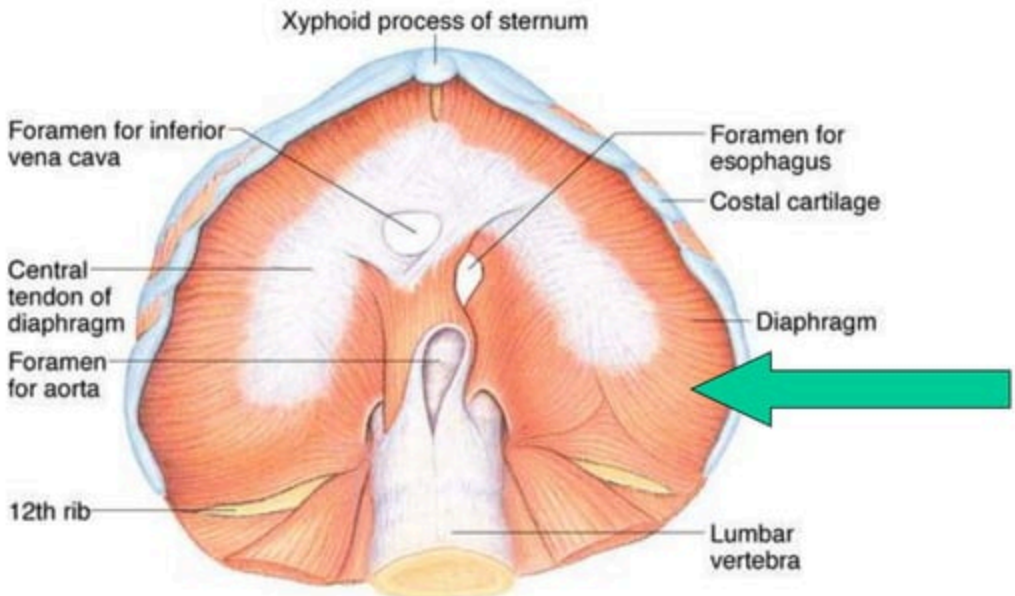


(a)

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Diaphragm

Inspiration



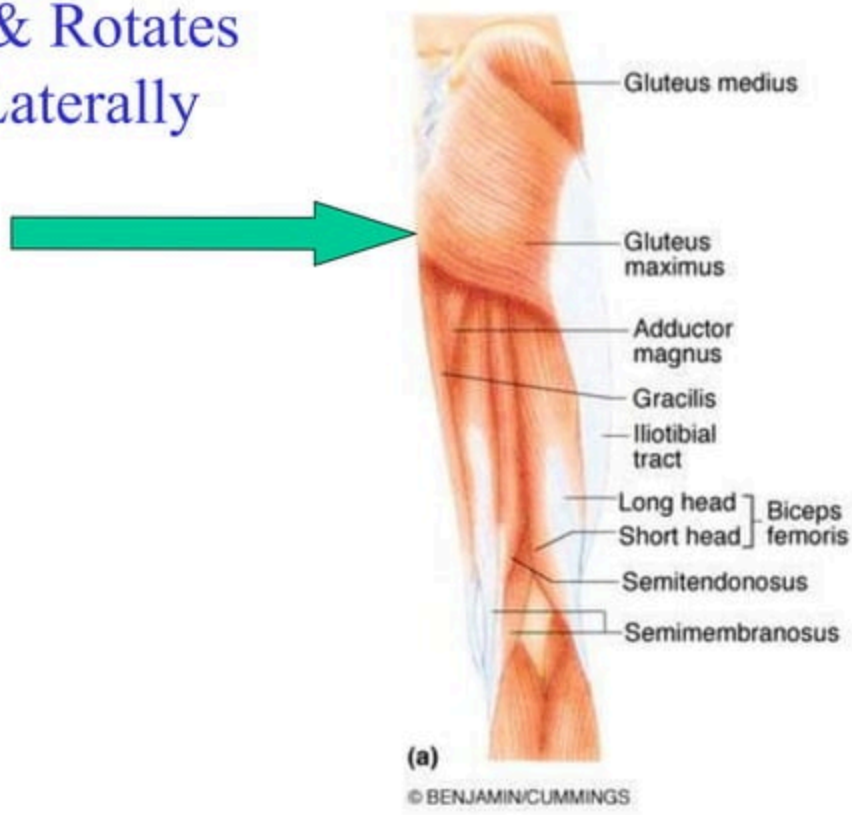
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Forearm Muscles

- Flexor carpi—Flexes wrist
- Extensor carpi—Extends wrist
- Flexor digitorum—Flexes fingers
- Extensor digitorum—Extends fingers
- Pronator—Pronates
- Supinator—Supinates

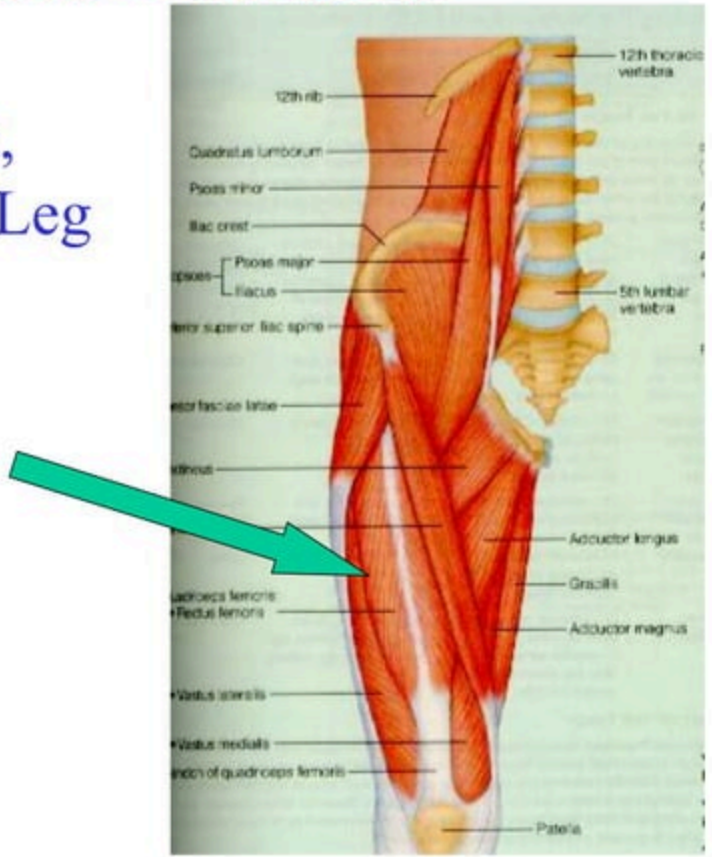
Gluteus Maximus

Extends & Rotates Thigh Laterally



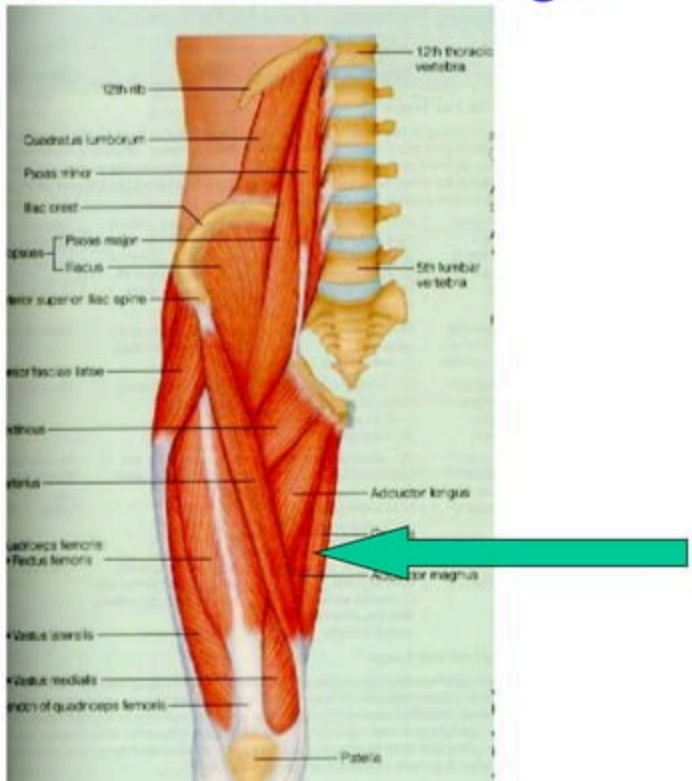
Rectus Femoris

Flexes Thigh,
Extends Lower Leg



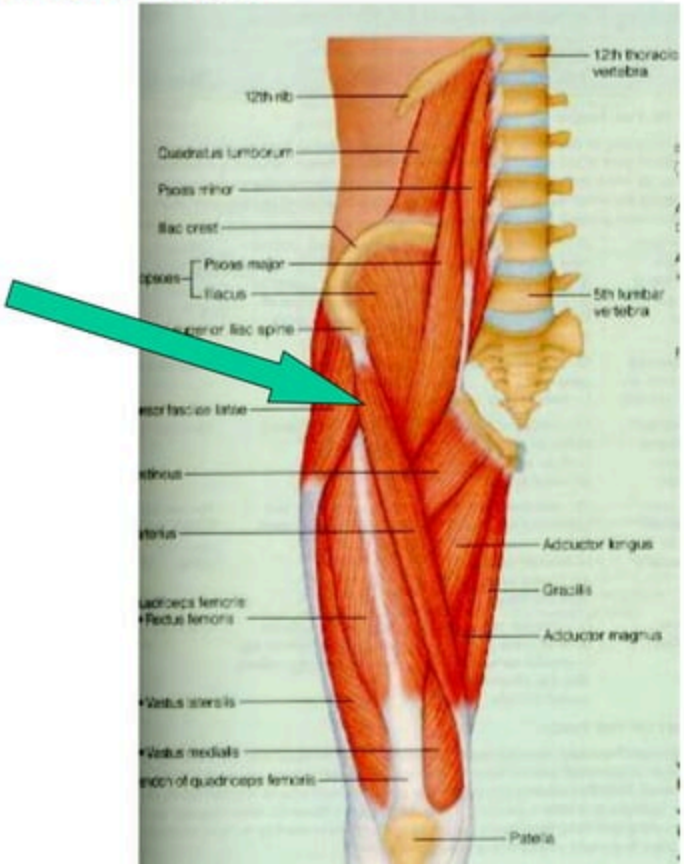
Gracilis

Adducts and Flexes Thigh



Sartorius

Flexes Thigh, &
Rotates Thigh
Laterally



Biceps Femoris

Extends Thigh &
Flexes Lower Leg



Gastrocnemius

Plantar Flexes Foot & Flex Lower Leg



Tibialis Anterior

Dorsiflexes and Inverts Foot

